IN THE CLAIMS:

Please amend the claims as indicated below:

1. **(Currently Amended)** A precision positioning device comprising:

a ~~hydraulic~~ pneumatic cylinder fixed so as to extend along the vertical direction;

a piston member slidably accommodated in the ~~hydraulic~~ pneumatic cylinder in a non-contact state via bearings, and including a piston head and a rod extending from the piston head along the central axis direction, the inside of the ~~hydraulic~~ pneumatic cylinder being divided into two pressure chambers by the piston head;

a ~~hydraulic~~ pneumatic circuit for supplying a ~~fluid~~ gas at a constant pressure to one of the two pressure chambers and supplying the ~~fluid~~ gas at a controlled flow rate to the other of the pressure chambers via a servo valve;

first and second pressure sensors for detecting pressures of the one and the other of the pressure chambers, respectively;

a position sensor for detecting the position of the piston member; and

a control system,

wherein the control system performs position control with respect to the piston member by controlling the servo valve based on a position detection signal from the position sensor, a position command value, a velocity command value, and an acceleration command value**[[;]]**, ~~and~~

wherein the control system performs force control with respect to the piston member by controlling the servo valve using pressure detection signals from each of the first and second pressure sensors and a load command value;

wherein the bearings are each a first hydrostatic bearing,

wherein the piston member has an aperture formed in the central axis portion

thereof and extending along the central axis direction thereof, and

wherein the position sensor is formed in the piston member through the use of a fixed shaft that has been inserted into the aperture from above the pneumatic cylinder.

2. **(Currently Amended)** The precision positioning device according to claim 1, wherein the control system ~~comprising~~ further comprises:

a position control system that performs the position control until the piston member arrives at a target position;

a force control system that performs the force control with respect to the piston member by a force based on the load command value, when the piston member arrives at the target position; and

a switching section that performs switching between the position control system and the force control system.

3. **(Currently Amended)** The precision positioning device according to claim 2, wherein the position control system ~~comprising~~ further comprises:

a disturbance observer for correcting a neutral point error in the servo valve; and

a Kalman filter for estimating a position, a velocity, and an acceleration of the piston member.

4. **(Currently Amended)** The precision positioning device according to claim 3, wherein the position control system further ~~comprising~~ comprises:

a linearization compensating section that compensates for a pressure change of each of the two pressure chambers due to a position change of the piston member, and that provides the compensated value to the switching section as a servo valve command value.

5. **(Currently Amended)** The precision positioning device according to claim 2, wherein the force control system ~~comprising~~ further comprises:

a first converting section for multiplying a pressure value detected by the first pressure sensor by the pressure receiving area of the piston head to calculate a first load value;

a second converting section for multiplying a pressure value detected by the second pressure sensor by the pressure receiving area of the piston head to calculate a second load value;

a first computing section for calculating the difference between the first load value and the second load value, as a piston load; and

a second computing section for calculating the difference between the calculated piston load and the load command value, as a thrust command value, and providing the calculated thrust command value to the switching section.

6. **(Canceled)**

7. **(Currently Amended)** The precision positioning device according to claim 1, ~~wherein the bearings are each a first hydrostatic bearing, and~~ wherein the first hydrostatic bearings are constructed by forming, in the piston head, first passages for introducing thereinto the ~~fluid~~ gas in the one of pressure chambers and blowing the ~~fluid~~ gas onto the inner wall of the ~~hydraulic~~ pneumatic cylinder.

8. **(Currently Amended)** The precision positioning device according to claim 7, wherein the piston member is a double cylindrical body, wherein the piston head has second passages formed therein for introducing the ~~fluid~~ gas that has been blown from the first hydrostatic bearings onto the inner wall of the ~~hydraulic~~ pneumatic

cylinder, into the double cylindrical body, and wherein the end portion of the piston member opposite to the piston head has an exhaust port formed therein for exhausting the ~~fluid~~ gas introduced into the double cylindrical body.

9. **(Currently Amended)** The precision positioning device according to claim 1, wherein the rod is slidably supported on the lower end of the ~~hydraulic~~ pneumatic cylinder in a non-contact state via second hydrostatic bearings, and wherein the second ~~hydraulic~~ hydrostatic bearings are constructed by forming, in the ~~hydraulic~~ pneumatic cylinder, a third passage for introducing thereinto the ~~fluid~~ gas in the one of the pressure chambers and blowing the ~~fluid~~ gas onto the outer wall of the rod.

10. **(Original)** A processing machine comprising the precision positioning device as recited in claim 1.

11. **(New)** A precision positioning device comprising:

a pneumatic cylinder fixed so as to extend along the vertical direction;

a piston member slidably accommodated in the pneumatic cylinder in a non-contact state via bearings, and including a piston head and a rod extending from the piston head along the central axis direction, the inside of the pneumatic cylinder being divided into two pressure chambers by the piston head;

a pneumatic circuit for supplying a gas at a constant pressure to one of the two pressure chambers and supplying the gas at a controlled flow rate to the other of the pressure chambers via a servo valve;

first and second pressure sensors for detecting pressures of the one and the other of the pressure chambers, respectively;

a position sensor for detecting the position of the piston member; and

a control system comprising:

a position control system,

a force control system, and

a switching section,

wherein the position control system performs position control with respect to the piston member by controlling the servo valve based on a position detection signal from the position sensor, a position command value, a velocity command value, and an acceleration command value;

wherein the force control system performs force control with respect to the piston member by controlling the servo valve using pressure detection signals from each of the first and second pressure sensors and a load command value,

wherein the position control system performs the position control until the piston member arrives at a target position; wherein the force control system performs the force control with respect to the piston member by a force based on the load command value, when the piston member arrives at the target position; and

wherein the switching section of the control system performs switching between the position control system and the force control system.

12. **(New)** The precision positioning device according to claim 11, wherein the position control system further comprises:

a disturbance observer for correcting a neutral point error in the servo valve; and

a Kalman filter for estimating a position, a velocity, and an acceleration of the piston member.

13. **(New)** The precision positioning device according to claim 12, wherein the position control system further comprises:

a linearization compensating section that compensates for a pressure change of each of the two pressure chambers due to a position change of the piston member, and that provides the compensated value to the switching section as a servo valve command value.

14. **(New)** The precision positioning device according to claim 11, wherein the force control system further comprises:

a first converting section for multiplying a pressure value detected by the first pressure sensor by the pressure receiving area of the piston head to calculate a first load value;

a second converting section for multiplying a pressure value detected by the second pressure sensor by the pressure receiving area of the piston head to calculate a second load value;

a first computing section for calculating the difference between the first load value and the second load value, as a piston load; and

a second computing section for calculating the difference between the calculated piston load and the load command value, as a thrust command value, and providing the calculated thrust command value to the switching section.

15. **(New)** The precision positioning device according to claim 11, wherein the piston member has an aperture formed in the central axis portion thereof and extending along the central axis direction thereof, and wherein the position sensor

is formed in the piston member through the use of a fixed shaft that has been inserted into the aperture from above the pneumatic cylinder.

16. **(New)** The precision positioning device according to claim 11, wherein the bearings are each a first hydrostatic bearing, and wherein the first hydrostatic bearings are constructed by forming, in the piston head, first passages for introducing thereinto the gas in the one of pressure chambers and blowing the gas onto the inner wall of the pneumatic cylinder.

17. **(New)** The precision positioning device according to claim 16, wherein the piston member is a double cylindrical body, wherein the piston head has second passages formed therein for introducing the gas that has been blown from the first hydrostatic bearings onto the inner wall of the pneumatic cylinder, into the double cylindrical body, and wherein the end portion of the piston member opposite to the piston head has an exhaust port formed therein for exhausting the gas introduced into the double cylindrical body.

18. **(New)** The precision positioning device according to claim 11, wherein the rod is slidably supported on the lower end of the pneumatic cylinder in a non-contact state via second hydrostatic bearings, and wherein the second hydrostatic bearings are constructed by forming, in the pneumatic cylinder, a third passage for introducing thereinto the gas in the one of the pressure chambers and blowing the gas onto the outer wall of the rod.

19. **(New)** A processing machine comprising the precision positioning device as recited in claim 11.

20. **(New)** A precision positioning device comprising:

a pneumatic cylinder fixed so as to extend along the vertical direction;

a piston member slidably accommodated in the pneumatic cylinder in a non-contact state via bearings, and including a piston head and a rod extending from the piston head along the central axis direction, the inside of the pneumatic cylinder being divided into two pressure chambers by the piston head;

a pneumatic circuit for supplying a gas at a constant pressure to one of the two pressure chambers and supplying the gas at a controlled flow rate to the other of the pressure chambers via a servo valve;

first and second pressure sensors for detecting pressures of the one and the other of the pressure chambers, respectively;

a position sensor for detecting the position of the piston member; and

a control system,

wherein the control system performs position control with respect to the piston member by controlling the servo valve based on a position detection signal from the position sensor, a position command value, a velocity command value, and an acceleration command value;

wherein the control system performs force control with respect to the piston member by controlling the servo valve using pressure detection signals from each of the first and second pressure sensors and a load command value;

wherein the bearings are each a first hydrostatic bearing; and

wherein the first hydrostatic bearings are constructed by forming, in the piston head, first passages for introducing thereinto the gas in the one of the pressure

chambers and blowing the gas onto the inner wall of the pneumatic cylinder.

21. **(New)** The precision positioning device according to Claim 20, wherein the piston member is a double cylindrical body;

wherein the piston head has second passages formed therein for introducing the gas that has been blown from the first hydrostatic bearings onto the inner wall of the pneumatic cylinder, into the double cylindrical body, and

wherein the end portion of the piston member opposite to the piston head has an exhaust port formed therein for exhausting the gas introduced into the double cylindrical body.

22. **(New)** The precision positioning device according to claim 20, wherein the control system further comprises:

a position control system that performs the position control until the piston member arrives at a target position;

a force control system that performs the force control with respect to the piston member by a force based on the load command value, when the piston member arrives at the target position; and

a switching section that performs switching between the position control system and the force control system.

23. **(New)** The precision positioning device according to claim 22, wherein the position control system further comprises:

a disturbance observer for correcting a neutral point error in the servo valve; and

a Kalman filter for estimating a position, a velocity, and an acceleration of the piston member.

24. **(New)** The precision positioning device according to claim 23, wherein the position control system further comprises:

a linearization compensating section that compensates for a pressure change of each of the two pressure chambers due to a position change of the piston member, and that provides the compensated value to the switching section as a servo valve command value.

25. **(New)** The precision positioning device according to claim 22, wherein the force control system further comprises:

a first converting section for multiplying a pressure value detected by the first pressure sensor by the pressure receiving area of the piston head to calculate a first load value;

a second converting section for multiplying a pressure value detected by the second pressure sensor by the pressure receiving area of the piston head to calculate a second load value;

a first computing section for calculating the difference between the first load value and the second load value, as a piston load; and

a second computing section for calculating the difference between the calculated piston load and the load command value, as a thrust command value, and providing the calculated thrust command value to the switching section.

26. **(New)** The precision positioning device according to claim 20, wherein the piston member has an aperture formed in the central axis portion thereof and extending along the central axis direction thereof, and wherein the position sensor

is formed in the piston member through the use of a fixed shaft that has been inserted into the aperture from above the pneumatic cylinder.

27. **(New)** The precision positioning device according to claim 20, wherein the rod is slidably supported on the lower end of the pneumatic cylinder in a non-contact state via second hydrostatic bearings, and wherein the second hydrostatic bearings are constructed by forming, in the pneumatic cylinder, a third passage for introducing thereinto the gas in the one of the pressure chambers and blowing the gas onto the outer wall of the rod.

28. **(New)** A processing machine comprising the precision positioning device as recited in claim 20.